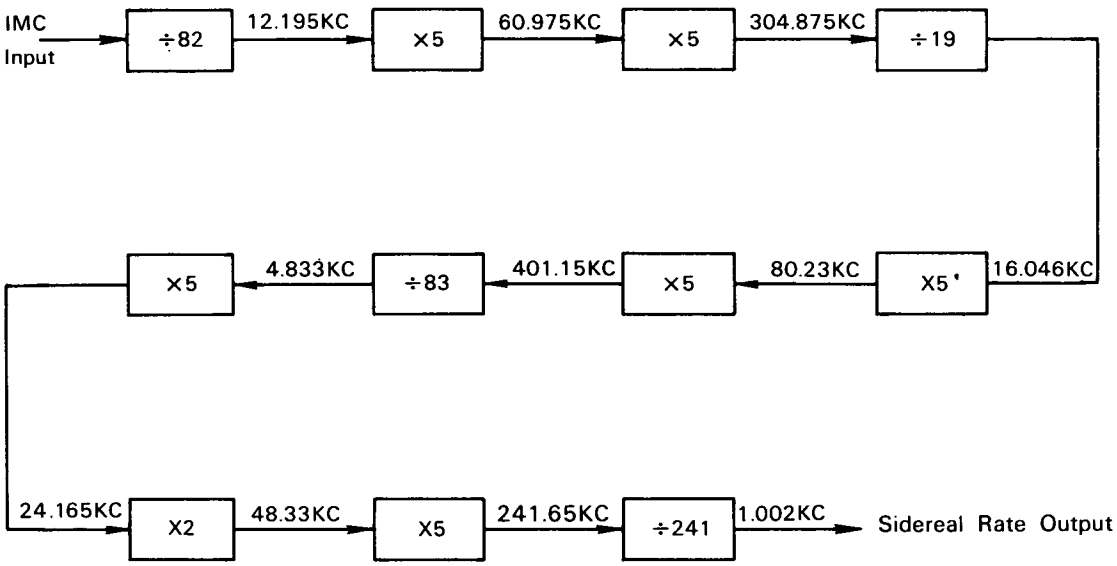
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

Binary System Generates Sidereal Rate from Standard Solar Rate



The problem: To develop a sidereal rate from a standard solar frequency (UT-2) to drive clocks and astronomical tracking devices. A solar frequency standard can be compared with other known standards (cesium-beam standards, VLF, WWV, etc.). The ratio of mean solar units to sidereal units is 1.0 to 1.002737909. The division of a solar rate by the reciprocal of this ratio, 0.997269566, produces the sidereal unit. This ratio is derived from the fact that, in mean solar time, a sidereal day is approximately 23 hours, 56 minutes, and 4.09 seconds. A sidereal day is defined as the interval between two successive transits of the first point of Aries over a meridian of any terrestrial point.

The solution: A sidereal generator that uses digital division and multiplication techniques to derive a sidereal rate output from a mean solar rate input.

How it's done: The sidereal rate generator uses a solar 1-megacycle-per-second frequency and performs the illustrated series of multiplications and divisions, producing the sidereal rate of 1.0027 . . . kilocycles per second. A clock designed to indicate mean solar time when driven at a solar 1-kilocycle per second rate will indicate sidereal time if driven at a solar 1.0027 . . . kilocycle-per-second rate.

The illustrated multiplications by 5 are performed by filters which remove the fifth harmonic of their respective inputs and by tuned amplifiers which amplify the resulting fifth-harmonic signal. The divisions are performed by standard binary dividers. The single multiplication by 2 is performed by a doubler circuit and a tuned amplifier. The sequence of multiplication and division operations was selected to result in frequencies at which tank circuits could

(continued overleaf)

be effectively constructed. The sequential operation also provides a fail-safe condition; if a malfunction or failure occurs at any segment, the output will also fail.

Notes:

1. This system would be useful for observatories and navigation stations or at any installation where a sidereal rate is required.
2. This system will be used to provide a sidereal rate to drive satellite tracking and astronomical devices during checkout and calibration.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland, 20771
   Reference: B64-10200

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C., 20546.

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(GSFC-190)